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Prospects for the uptake of renewable energy technologies in rural Tanzania

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Abstract

Despite concerted efforts to encourage the use of renewable energy technologies (RET) such as solar home systems, their widespread adoption in many rural areas is yet to take place especially in Africa. There is already a considerable body of research on the factors influencing people to adopt and apply RET. However, such work has tended to focus on populations in the developed world using rational models of decision-making based on information, regulations and economics in quantitative methods. This study employed a qualitative approach to explore community perceptions, awareness and attitudes towards new technologies to examine how they might have impacted adoption and diffusion of RET in six randomly selected villages in Mtwara district, southern Tanzania. Data sources were focus group discussions and participant observations. A vast majority of study participants were unfamiliar with the various types of RET and were not using any of the RET for their energy consumption. Most participants in focus group discussions perceived RET similar to other development interventions set to raise their living standard but failed to yield expected outcome. Early understanding of perceptions and attitudes of communities towards new technologies is necessary to facilitate communities in rural areas to accept and transit to using RET.

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Keywords: Renewable energy technologies; Tanzania; diffusion; perceptions; attitude; qualitative approach.

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1. Introduction

The energy use in many developing countries has remained fairly static over the last century [1]. Attempts to introduce modern energy services to reach the majority of rural populations for foreseeable future have been slow and even proved futile in certain cases [2]. Many developing countries continue to rely on fast-depleting fossil fuels and expensive oil imports to satisfy the energy demands of the economy [3]. As a result, populations in those countries continuously face numerous energy challenges with negative implications for human health, the environment, and economic productivity [4]. Recent studies [5] indicate that many households experience energy poverty; they are unable to gain sufficient access to modern energy services such as mechanical power and electricity.

As these challenges have become increasingly severe, and the trend of the increasing importance of energy security and sustainable development is growing, an energy transition to sustainable energy provision has become ever more significant [6]. Policy makers are increasingly considering making an energy transition to meet the growing energy demand through an increase in energy efficiency and an uptake of modern energy technologies, especially from renewable sources, in the share of an energy generation mix [7]. They are embracing renewable energy (RE) as key energy forms, especially in generating electricity that could be supported and pursued to prevent climate change and improve domestic energy security [8]. Adoption of RE in developing countries can also be an opportunity to 'leapfrog' over developed countries in the production of clean energy [9].

Despite concerted efforts to encourage the use of renewable energy technologies (RET) such as solar pump, wind-powered pump, solar cooker, solar PV and wind turbine generator [10], their widespread adoption in many rural areas is yet to take place especially in Africa [11]. For instance, RE has until very recently contributed little to the overall share of energy mix in many countries of sub-Saharan Africa (SSA), compromising the timely achievement to reach the 11 % target set for this region [12]. Among the southern African countries, South Africa is much more pro-active and envisages about 42 % of electricity generated from renewable resources by 2030 [13].

There is already a considerable body of research on the factors influencing people to adopt and apply RET as viable alternatives to energy use [14]. Nevertheless, such works have tended to focus on populations in the developed world using rational models of decision-making based on information, regulations and economics in quantitative methods [15]. There is limited empirical qualitative information within the literature on energy issues describing how social factors can be viable in the long term for almost exclusively rural populations in SSA to adopt RET. Therefore, this research intends to fill this gap by exploring sociocultural factors and the extent to which they hinder adoption of RET. It also considers the potential for achieving the benefits of RET through an understanding of values placed to new technology in a social setting. The main research question guiding the present study is: how do perceptions, awareness and attitudes of rural populations related to technological development influence their decision to adopt RET? As such, this study is based on rural populations in the coastal villages of Mtwara district in southern Tanzania. Recent reports by the government show that the demand of energy for domestic purposes in rural Tanzania—where grid electricity is accessible to around 5% of the rural population—is increasing at a rapid pace [16]. This implies that there is still an urgent need to encourage and promote the supply of affordable energy sources in rural areas where the majority of the country's population live [17].

2. Methodology

Participants for this research were recruited with the help of village governments and villages' environmental management committees. While participants were required to be interested in the topic of energy, they did not need to have specific expertise or experiences in this topic. Instead, proxy characteristics to energy issues, such as sustainable production of charcoal, access to electricity, replantation of mangroves, charging mobile phones, urban lifestyles, solar lighting, wind pumps, and natural gas, were presented to potential participants as what focus group discussions would be about. More specifically, inclusion criteria set were age and gender with an interest in the above-mentioned issues. A total of 49 individuals participated in the focus-group discussions of seven to nine participants in each study village. Verbal consent was requested from participants before conducting discussion.

Data sources were focus group discussion meetings (FGDs) and participant observations. The discussions started with ordinary conversation to build rapport with participants and to collect basic socio-demographic information.

The guiding questions were based on literature reviews. Beginning with an unstructured question ("Could you tell me about the energy sources you are currently using?"), the discussion proceeded with focussed questions, such as: "How do your social norms, relations and rules influence the experience of energy sources, both old and new?"; "Have you heard the term 'renewable energy' and what does it mean to you?"; "How do you feel about RE?" and "Do you think renewables are important to you, why?" These questions were not asked at once; were broken down and taken piece by piece. Next, discussion questions addressed the following issues: possible reasons existing for switching (or not) to renewable energy; opinions regarding why there are few activities and initiatives for implementation of renewable technology; perceptions of the relationship between renewable and improved socio-economic conditions; and explanations as to why it is difficult for rural people to leave biomass fuels behind. The discussions then followed a recursive style using probes to elicit additional information on attitudes and perceptions towards renewables and to encourage reflection on important factors for the adoption of renewables. At the convenience of the participants, focus-group meetings were held mainly at a village office facility. FGDs were led by a moderator and a recorder who took notes. Most participants did not want to be recorded; therefore, all FGDs were not recorded on a digital voice recorder. All FGDs were conducted in Swahili and averaged 90 minutes in length. Only one FGD session was conducted in each study village. In total, 6 FGDs, with 21 women and 28 men, were conducted.

Direct observation involved either spending the day with women collecting firewood or staying overnight in villages. The intention was to provide a systematic analysis of current energy uses and mix. Furthermore, participant observations facilitated familiarisation with attitudes towards energy use and enabled the researcher to build rapport with community members.

3. Results and discussion

The findings of this study show that levels of awareness of the terminology 'energy' and the related impacts on socio-economic development and the environment, among local communities are rather low. Specifically, many participants in this study had lower levels of awareness and understanding of the options for RET compared to other emerging technologies such as techniques for irrigation. Those who knew of it were either uncertain or had an abstract understanding about the claimed environmental benefits of RET schemes. Participant observations revealed a lack of displays or activities that raise awareness and that could shape villagers' understanding of RET. The present study identifies some important local misconceptions about RET. A vast majority of participants considered RET, such as solar panels for home use, to be an emerging technology and less affordable to them, and thus they linked it with a changing lifestyle that could evolve following a remarkable change in their livelihood activities. This aligns with [16] who on the study about attitudes on energy security in the United Kingdom mentioned that characteristics such as unfamiliarity and complex nature of issues such as energy security may make it more likely that people do not have fully-formed views about energy issues. Consequently, examining community perceptions on RET would have similarities with examining community perceptions of emerging technologies or other complex environmental issues such as geoengineering [18]. Unless local populations have a concise knowledge of the energy sources and their impacts on their well-being and environment, their concerns about adopting RET will be relatively low and it will be difficult for them to support projects related to RET at any significant levels.

As presented earlier, the current study found that although RET is spreading, it still represents a small part of the energy mix at a local level. With the impacts of climate change, the government is attaching great importance to adaptation options [19]. There is also a desire to attract mitigation and this should go along with increasing community awareness of sustainable energy uses [19]. While there is a general awareness of environmental issues and broad concern about climate change [20], the shift towards RET does not seem to be influenced by this condition. Consequently, the public as was in the study villages do not see different aspects of RET as overarching effort for sustainable development, but just a singular initiative to increase access to electrification and less likely for their common domestic use of energy-cooking. Future research should use focus-group discussion and structured interviews to investigate whether communities who have experienced a lack of grid-electricity for a long time, as was the case in this study, would show interest in the types of RET as long as the electricity supply is stable and sufficient to support their daily lives. This will help to obtain information about the kinds of attitude which may lead to the success of any environmental issue.

4. Conclusion

The results of this study suggest rural people would more likely seek RET if they get appropriate information, and many participants of this study said that they needed and wanted knowledge of RET to help them improve their lives and reduce deforestation, which has a huge impact on the environment. The study argues that framing community content for RET promotion around attitudes and perceptions can provide culturally relevant entry points for shifting suspicious ideas towards the use of RET. These efforts need to be supported by structural changes that diminish economic, legislative and institutional barriers to RET. Important conclusions drawn from this study may be applied for sustainable energy planning, the design of good energy policies, the promotion of innovative energy technologies, and more environmentally friendly policies, as well as investment programmes utilising RET that extend far beyond the rhetoric target of leapfrogging the carbon age by 2030 in rural areas in Tanzania with clean energy.

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